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A revisionary study of the genus *Dundubia* Amyot & Serville (Homoptera, Cicadidae)

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ABSTRACT

In this paper most of the 12 known species and varieties of *Dundubia* are described and figured. Keys to both sexes of the species are given. Three new species, *D. simalurensis, D. solokensis,* and *D. cochlearata* are added. Characters of diagnostic value are chiefly found in the structure of the uncus in the male genitalia and in the shape of the male operculum. In most cases the female sex could be separated on account of the shape of the operculum and the outline of the abdomen. Furthermore, the value of the structure of the male genitalia for establishing the relationship of some genera of the tribe Dundubiini is discussed. The characteristic rounded pygofer indicates the close relationship of the genera *Dundubia* and *Orientopsaltria* Kato. In contrast to the condition in these genera we found spine-like projections on both sides of the pygofer in the genera *Cosmopsaltria* Stål, *Diceropyga* Stål, *Fatima* Distant, and *Sawda* Distant.

The genus *Dundubia* was erected by Amyot & Serville in 1843 for the following species: *Tettigonia vaginata* Fabricius, *Cicada chlorogaster* Boisduval, *Cicada doryca* Boisduval, and *Tettigonia spinosa* Fabricius. The authors did not designate a type-species of *Dundubia.* As such *D. vaginata* was selected by Westwood (1843).

In Walker's „List of Homoptera" of 1850 a group of 41 species, now belonging to different genera of the tribe Dundubiini, was mentioned under the generic name *Dundubia.* Although Walker added a large number of new species, he did not make an attempt at their classification.

Stål's excellent work on the classification of the Cicadidae introduced a new period in the study of these insects. Stål (1866 a) established the genus *Cosmopsaltria* for the species of *Dundubia* characterized by a long rostrum and a postclypeus not twice as broad as the anterior lateral margins of the vertex, and in doing so he made a first step towards a subdivision into more natural categories. In a subsequent publication, Stål, 1870, arranged the species of *Cosmopsaltria* in the following three subgenera: *Cosmopsaltria*

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Stål, 1866, *Diceropyga* Stål, 1870, and *Platylomia* Stål, 1870. Distant (1905) considered the characteristic features of these subgenera sufficient to justify a separation on generic level.

In Distant's "Monograph of Oriental Cicadidae" of 1889, still the most comprehensive work on Indo-Malayan Cicadidae, most of Walker's species originally included in *Dundubia* were reallocated in *Cosmopsaltria* and other genera. Only a group of nine closely related species was referred to *Dundubia*. Since Distant's Monograph (1889) a few new species were added to *Dundubia* by Distant (1912, 1917), Haupt (1918), Moulton (1923) and Liu (1940). As a result, therefore, only 13 species and varieties are enumerated in Metcalf's "General Catalogue of the Homoptera", Cicadidae, fasc. 8 (1963).

In spite of this rather small number of species our preliminary attempts to identify the rather large material of *Dundubia* in the Zoölogisch Museum, Amsterdam, met with substantial difficulties, and it was soon realized that a critical study of the genus was needed to come to satisfactory results.

For this study we included, besides the material of the Amsterdam Museum, also the rich collection of the Rijksmuseum van Natuurlijke Historie, Leiden. Moreover, some types in the British Museum (Natural History), London, were examined.

In the enumeration of the material for each species studied the following abbreviations have been used:

BM — British Museum (Natural History), London
RML — Rijksmuseum van Natuurlijke Historie, Leiden
ZMA — Zoölogisch Museum, Amsterdam.

For the loan of material our thanks are due to the authorities of these museums. To Dr. R. J. Izzard (British Museum), to Dr. H. C. Blöte and Drs. P. H. van Doesburg (Rijksmuseum van Natuurlijke Historie, Leiden) gratitude is expressed for generous help in various ways.

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Dundubia Amyot & Serville, 1843

1843 Amyot, C. J. B. & A. Serville: 470.
1866a Stål, C.: 5.
1889 Distant, W. L.: 38.

With the erection of *Dundubia* by Amyot & Serville in 1843 the genus was defined as follows: "Tête triangulaire, son bord antérieur gros et assez notablement avancé; front ayant un sillon longitudinal court au milieu. — Yeux gros, ovalaires, assez saillants. — Prothorax non dilaté de chaque côté. — Opercules des mâles d'une longueur extraordinaire, s'étendant presque jusqu'à l'extrémité de l'abdomen."

Stål (1866a) emphasized the importance of the following characters for the

distinction of the genus *Dundubia*: Rostrum scarcely or not reaching the posterior coxae. Postclypeus at the base twice as broad as the anterior lateral margin of the vertex. Operculum long. Apart from these features Distant (1889) characterized the genus *Dundubia* in general appearance by the rather large size, the mostly unicoloured green or yellow to brownish body and especially by the entirely hyaline tegmina and wings.

The genus-concept of *Dundubia* as given by Distant (1889) agrees very well with our present day opinion.

As stated in a previous paper (Duffels, 1965) a very characteristic feature for distinguishing some genera of the tribe Dundubiini was found in the shape of the pygofer. On account of the presence of the spine-like projections on both sides of the pygofer, the genus *Cosmopsaltria* seems to be closely allied to *Diceropyga* Stål, 1870, *Fatima* Distant, 1905, and *Sawda* Distant, 1905. In contrast with the condition in these genera, we found rounded lateral lobes in the pygofer of *Dundubia*. Kato (1944) also emphasized the importance of the shape of the pygofer by separating *Orientopsaltria* Kato, 1944, from *Cosmopsaltria* on account of the absence or presence of the spine-like projections.

The characteristic rounded pygofer of *Dundubia* and *Orientopsaltria* indicates the close relationship of both genera. Nevertheless the genus *Dundubia* can be distinguished at once by the hyaline, unspotted tegmina, whereas *Orientopsaltria* is provided with fuscous spots on the tegmina.

The present revisionary study of the genus *Dundubia* will include the description of three new species *D. simalurensis* sp. n., *D. solokensis* sp. n., and *D. cochlearata* sp. n. With these additions, the list of species, with the synonymous names, reads as below.

D. vaginata (Fabricius, 1787)
  syn. *Cicada mannifera* Linnaeus, 1754 (excl. syn.)
    Tettigonia vaginata Fabricius, 1787
    Cicada virescens Olivier, 1790
    Dundubia immacula Walker, 1850
    Dundubia sobria Walker, 1850
    Dundubia mannifera var. *a* Distant, 1889
D. vaginata var. *nigrimacula* Walker, 1850
  syn. *Dundubia nigrimacula* Walker, 1850
D. simalurensis sp. n.
D. solokensis sp. n.
D. cochlearata sp. n.
D. rufivena Walker, 1850
  syn. *Dundubia intemerata* Walker, 1856
    Fidicina confinis Walker, 1868 (syn. n.)
    Dundubia mellea Distant, 1889
D. rafflesii Distant, 1883
D. terpsichore (Walker, 1850)
  syn. *Cephaloxys terpsichore* Walker, 1850
    Dundubia intemerata (Walker, 1856) (sensu Moulton, 1923) (syn. n.)
D. kebuna Moulton, 1923
D. emanatura Distant, 1889
D. aerata Distant, 1888
D. helena Distant, 1912

D. longina Distant, 1917
D. bifasciata Liu, 1940
D. siamensis Haupt, 1918

The distribution of the species of *Dundubia* extends through the Malay Archipelago north to India and China.

Key to the species. — Characters of diagnostic value for separating the species are chiefly found in the structure of the uncus in the male genitalia and the shape of the opercula of the male. Not all the characters of the male genitalia have been used in this key to the species. For these features reference should be made to the accompanying figures.

In the females of some species on the other hand, possibilities for specific distinction exist in the shape of the operculum and the abdomen. In a small number of species other features, such as the black fasciae on the head or the mesonotum, the bronze tinged tegmina and wings, contribute to a distinction of the species.

Up to now the females of four species (*D. cochlearata* sp. n., *D. helena* Distant, *D. bifasciata* Liu and *D. siamensis* Haupt) are unknown. The female of *D. kebuna* Moulton was insufficiently described and, unfortunately, was not deposited in the collection of the British Museum.

For these reasons the above mentioned five species could not be included in the key to the females.

MALES

1. Tegmina and wings bronzed hyaline. Body length 54 mm (For operculum see fig. 23; for genitalia fig. 22) ..... *D. aerata* Distant, 1888
— Tegmina and wings hyaline or slightly bronze tinged. Body length less than 47 mm 2
2. Tip of the operculum rounded 3
— Tip of the operculum pointed 11
3. Head with a narrow black transverse fascia between the eyes, enclosing the ocelli. Operculum rather narrow, apical part slightly curved laterad (fig. 24) .... *D. emanatura* Distant. 1889.
— Head without black fascia. Operculum spoon-shaped, not curved laterad 4
4. Operculum nearly twice as long as broad (figs. 15 & 16). Apical part of the operculum about twice as broad as the base. (For genitalia see fig. 17) .... *D. rufivena* Walker. 1850
— Operculum more than twice as long as broad. Apical part of the operculum about as broad as or somewhat broader than the base 5
5. Operculum strongly constricted at one third from the base (fig. 19). Pronotum with a median black spot in front of the pronotumcollar. Mesonotum with two converging paramedian black lines. (For genitalia see fig. 18) .... *D. rafflesii* Distant. 1883
— Operculum rather weakly constricted. Mesonotum with or without black lines .. 6
6. Operculum very long, reaching the eighth abdominal segment (fig. 26). Head, thorax and abdomen brownish ochraceous. Mesonotum with two converging paramedian black lines ..... *D. longina* Distant. 1917
— Operculum reaching the fifth to the seventh abdominal segment. Head, thorax and

abdomen ochraceous or bright green. Mesonotum without black lines 7
7. Operculum narrow (fig. 25) ..... *D. helena* Distant, 1912
— Operculum rather broad 8
8 Uncus with two broad, obtuse uncus lobes (figs. 1, 3, 5, & 7) 9
Uncus with two sharply pointed uncus lobes (figs. 9 & 14) 10
9. Lateral sides of the abdomen with black spots on the third to eighth or fourth to seventh segments. (For operculum see fig. 8, for genitalia fig. 7) .... *D. vaginata* (Fabricius, 1787) var. *nigrimacula* Walker, 1850
— Abdomen unicoloured without black spots. (For operculum see figs. 2, 4 & 6, for genitalia figs. 1, 3 & 5) ..... *D. vaginata* (Fabricius, 1787)
10. Apex of the narrow uncus lobes turned laterad (fig. 14). (For operculum see fig. 13) ..... *D. cochlearata* sp. n.
— The rather narrow uncus lobes with a straight apical part (fig. 9). (For operculum see fig. 10) ..... *D. simalurensis* sp. n.
11. Operculum tapering to the very sharply pointed tip (fig. 21) 12
— Operculum rather broad up to the tip (fig. 12) 13
12. Body green to bright ochraceous, unicoloured. (For operculum see fig. 21, for genitalia fig. 20) ..... *D. terpsichore* (Walker, 1850)
— Head, thorax and abdomen castaneous-brown, with black-brown tympanal coverings and opercula ..... *D. kebuna* Moulton, 1923
13. Head, thorax and abdomen brownish to ochraceous. Tympanal coverings and opercula greenish. Mesonotum with two narrow converging paramedian black fasciae. Pronotum with a transverse black spot before the middle of the posterior margin ..... *D. bifasciata* Liu, 1940
— Head, thorax and abdomen black-brown or bright green. Pro- and mesonotum without black markings 14
14. Head, thorax and abdomen black-brown. Lateral sides of the abdomen with a dark-coloured spot on the second to fourth abdominal segments .... *D. siamensis* Haupt. 1918
— Head, thorax and abdomen bright green. (For operculum see fig. 12, for genitalia fig. 11) ..... *D. solokensis* sp. n.

Females

1. Tegmina and wings bronzed hyaline. Body length 45—55 mm. Ovipositor protruding very long (fig. 49). (For operculum see fig. 50) ..... *D. aerata* Distant, 1888
— Tegmina and wings hyaline or slightly bronze tinged. Body length less than 40 mm 2
2. Head with a narrow black transverse fascia between the eyes, enclosing the ocelli. Operculum with a small lateral tooth (fig. 48). (For abdomen see fig. 47) .... *D. emanatura* Distant, 1889
— Head without a black fascia. Operculum without lateral tooth 3
3. Mesonotum with two converging paramedian black lines 4
— Mesonotum without black lines 5
4. Medium sized species, body length 26—30 mm. (For operculum see fig. 44, for abdomen fig. 43) ..... *D. rafflesii* Distant, 1883
— Rather large species, body length 42 mm. (For abdomen see fig. 51) .... *D. longina* Distant, 1917
5. Tip of the abdomen rather obtuse, curved upwards in a lateral aspect (figs. 35, 37 & 39) 6
— Tip of the abdomen rather sharply pointed, hardly curved upwards in a lateral aspect (figs. 27, 29, 31, 33 & 45) 7
6. Large bright green species. Body length 32—35 mm, length of the tegminum 45 mm. (For operculum see fig. 36, for abdomen fig. 35) ..... *D. solokensis* sp. n.

— Medium-sized species. Colour very variable, bright green to dark ochraceous. Body length 23—34.5 mm, length of the tegminum 30—41 mm. (For operculum see figs. 38 & 40, abdomen figs. 37 & 39) ..... *D. rufivena* Walker, 1850

7. Lateral sides of the abdomen with black spots on the third to eighth or fourth to seventh segments. (For operculum see fig. 32, for abdomen fig. 31) ..... *D. vaginata* var. *nigrimacula* Walker, 1850

— Lateral sides of abdomen without black spots 8

8. Small species. Body length 26—28 mm. Operculum rather sharply pointed. Apex directed mesad (fig. 46). (For abdomen see fig. 45) ..... *D. terpsichore* (Walker, 1850)

— Large species. Body length more than 30 mm. Apex of operculum rounded or obtusely pointed in an outward direction. (For operculum of *D. vaginata* see figs. 28 & 30, for abdomen figs. 27 & 29; for operculum of *D. simalurensis* see fig. 34, for abdomen fig. 33) ..... *D. vaginata* (Fabricius, 1787)
D. simalurensis sp. n.

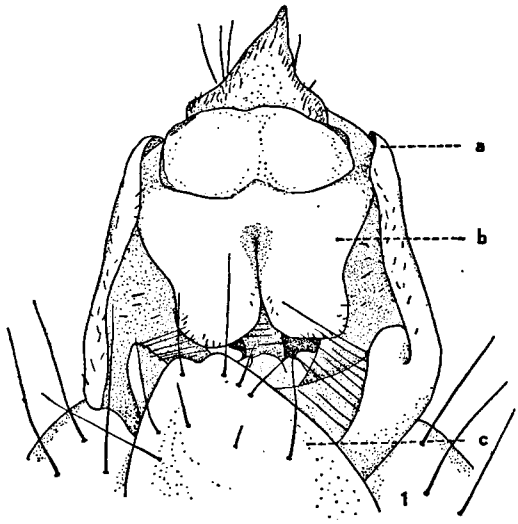
In the present paper the references for each species have been restricted to the literature of importance for this revision. For a more complete list of literature the reader is referred to Metcalf's "General catalogue of the Homoptera" fasc. 8, 1963. Because of the fact that this catalogue gives also the detailed geographic distribution of each species, as given by the authors of the references, we confine ourselves to the indication of the distributional area.

Dundubia vaginata (Fabricius, 1787). Figs. 1—6, 27—30.

1754 *Cicada mannifera* Linnaeus, Mus. Ad. fried.: 84 (excl. syn.).
1787 *Tettigonia vaginata* Fabricius, Mant. Ins., **2**: 266.
1790 *Cicada virescens* Olivier, Encycl. meth., **5**: 747.
1850 *Dundubia immacula* Walker, List Hom., **1**: 50.
1850 *Dundubia sobria* Walker, List Hom., **1**: 63.
1866 *Dundubia mannifera;* Stål, Berl. ent. Z., **10**: 170.
1889 *Dundubia mannifera* var. *a* Distant, Monogr. Orient. Cicad., part 2: 39.
1892 *Dundubia mannifera* var. *terpsichore;* Distant, loc. cit. part 5: pl. 12 figs. 1, a, b.

Material examined. — Sumatra 1 ♂ (type of *Tettigonia vaginata*) BM, Banks collection. China, Hongkong 1 ♀ (type of *Dundubia sobria*) BM. Tenasserim 1 ♂ (type of *Dundubia immacula*) BM. Java: [Tandjoeng] Priok, II. 1924 (Dr. Buitendijk) 1 ♂, RML. Borneo: Borneo, 1889, 1 ♂, RML; Borneo North, 1 ♂, BM; Long Nawang, 1925 (Mjöberg) 1 ♂, ZMA; Serawak, 1931 (J. M. Bryan) 2 ♂, BM. Philippines: Mindanao, Surigao, 1 ♂ 1 ♀, ZMA; Luzon, 1 ♂, ZMA; Luzon, 1926 (C. F. Baker) 1 ♂, BM. Sumatra: Atjeh (Mr. W. Baerts) 1 ♂, RML; Bekri, Deli (Pantekoek) 1 ♂ 1 ♀, RML; Benkoelen, 1911 (Abdul Rachman) 1 ♂, RML; Benkoelen, 1920 (C. J. Brooks) 1 ♂, BM; Pager Alang (J. de Vos tot Nederveen Cappel) 1 ♀, RML; Fort de Kock, 1925 (E. Jacobson) 1 ♂, RML; Fort de Kock, 1926 (E. Jacobson) 1 ♂, RML; Indragiri, 1895 (M. L. van Hasselt) 1 ♂, RML; Lahat, 10.II.1948 (W. C. Verboom) 1 ♂, RML; Laut Tador, 8.IV.1951 (R. Straatman) 1 ♂, RML; Loeboe Bankoe, V.1904 (J. Menzel) 1 ♂, RML. Loeboe Bankoe, V.1905 (J. Menzel) 2 ♀, RML; Medan (De Bussy) 3 ♂,

Figs. 1—4. *Dundubia vaginata* (Fabricius). — 1. ♂ from Sumatra, Medan. Genitalia. a, pygofer (abdominal segment IX); b, uncus; c, sternite VIII. — 2. The same. Abdomen with operculum. — 3. ♂ from Riouw. Genitalia. Lettering as in fig. 1. — 4. The same. Abdomen with operculum.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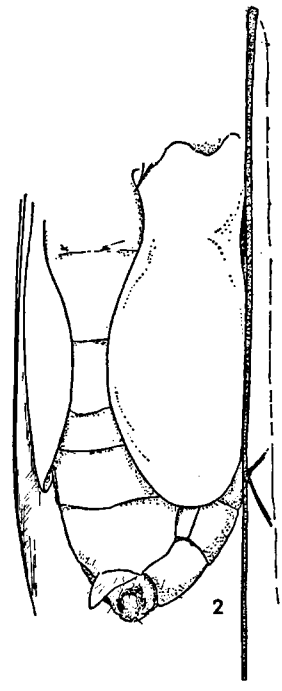
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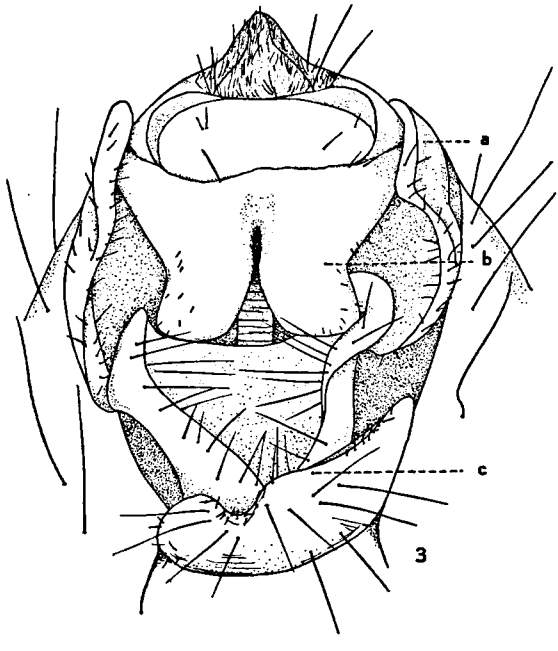
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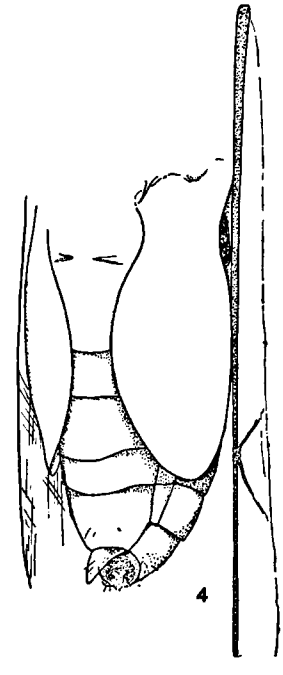
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ZMA; Merapi, VI.1931 (J. Kool) 1 ♂, ZMA; North Korintji Valley, IX-X.1921, 1 ♂, ZMA; Padang, Deli, 1885 (E. Büttikofer) 1 ♂, RML; Padang, Sidempoean, 1894 (L. v. Hasselt) 1 ♂, RML; Padang, Sidempoean (J. D. Pasteur) 1 ♂, RML; Pjibodas, 24.III. 1892 (Dr. J. v. Bemmelen) 1 ♂, RML; Seumanjam, Meulaboh, W. Atjeh, 13.III.1954 (R. Straatman) 1 ♂, RML; Soerian, Padang, IV.1909 (P. O. Stolz) 2 ♂, RML; Solok, 1913 (P. O. Stolz) 1 ♂, RML; Sumatra (J. de Vos tot Nederveen Cappel) 1 ♂, RML; Sumatra, 1 ♂, BM; Sumatra's Oostkust, 1926 (E. Jacobson) 1 ♂, BM; Sumatra's Westkust, 1922—'23 (H. Wittenrood) 1 ♂, RML; Tandj. Andalas, V.1914 (E. Jacobson) 1 ♀, RML. Riouw Archipel: Riouw (Kluit) 1 ♂, ZMA. Malaya: Perak, Taiping, 1948 (P. G. Coleman) 3 ♂, BM; Perak, Taiping, 1948 (H. T. Pagden) 1 ♂, BM; Penang, XI.1934 (J. M. Forsyth) 1 ♂, BM. Tenasserim: Tenasserim, 1 ♀, BM. Without locality: 3 ♂, ZMA; 1 ♂ 1 ♀, RML.

Description. — Colour. Head, thorax and abdomen ochraceous to brownish ochraceous or green. Colour very variable. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at the base as the anterior lateral margins of the vertex. Rostrum passing the intermediate coxae, hardly reaching the posterior coxae. Apex of rostrum black.

Operculum. Opercula of the male (figs. 2, 4 & 6) elongate extending to the sixth or seventh abdominal segment. Operculum concavely sinuate on each side in the basal half, apex of the operculum rounded. Opercula of the female (figs. 28 & 30) broad near the base, apex rounded or obtusely pointed in a lateral direction.

Male genitalia (figs. 1, 3 & 5). The uncus has two broad lobes.

Abdomen of the female (figs. 27 & 29). Tip of the abdomen rather sharply pointed, in a lateral aspect hardly curved upwards. In some females hind margins of the last abdominal segments black coloured (fig. 27).

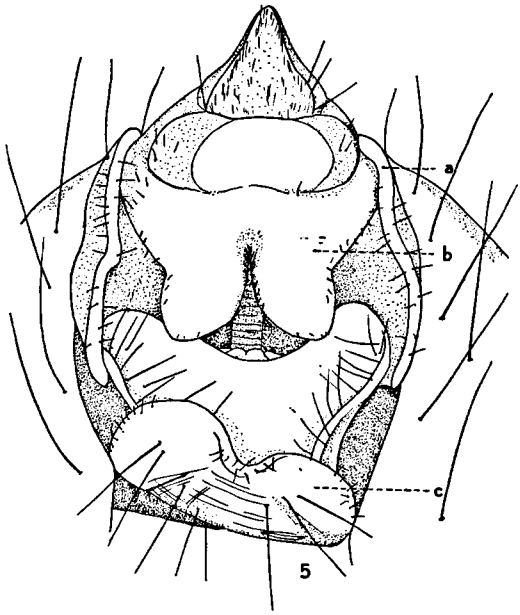
Measurements. Male: Length of the body 35.0—45.0 mm, length of tegminum 42.0—53.1 mm, greatest width of head 11.8—13.8 mm, based on 33 specimens. Female: Length of the body 30.0—39.0 mm, length of tegminum 41.1—47.7 mm, greatest width of head 11.2—13.0 mm, based on 8 specimens.

The specimens from the Philippines (length of the body in male 35.0—36.5 mm, 2 specimens; in female 30.0 mm, 1 specimen) and from Riouw (length of the body in male 37.0 mm, 1 specimen) are smaller than the robust form occurring on Borneo and Sumatra (length of the body in male 38.8—45.0 mm, 29 specimens; in female 35.0—39.0 mm, 7 specimens).

Habitat. — Common throughout the Malay Archipelago, ranging north to India and China. The species was doubtfully recorded from Australia (Burns, 1957).

Synonymy. — A discussion of the synonymy of the species has to be preceded

Figs. 5—6. *Dundubia vaginata* (Fabricius), ♂ from Philippines, Mindanao, Surigao. — 5. Genitalia. a, pygofer; b, uncus; c, sternite VIII. — 6. Abdomen with operculum. — Figs. 7—8. *Dundubia vaginata* var. *nigrimacula* Walker, ♂ from Java, G. Slamat, IV-1917. — 7. Genitalia. Lettering as in fig. 5. — 8. Abdomen with operculum.



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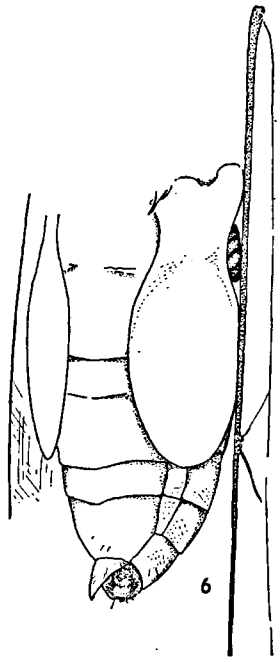

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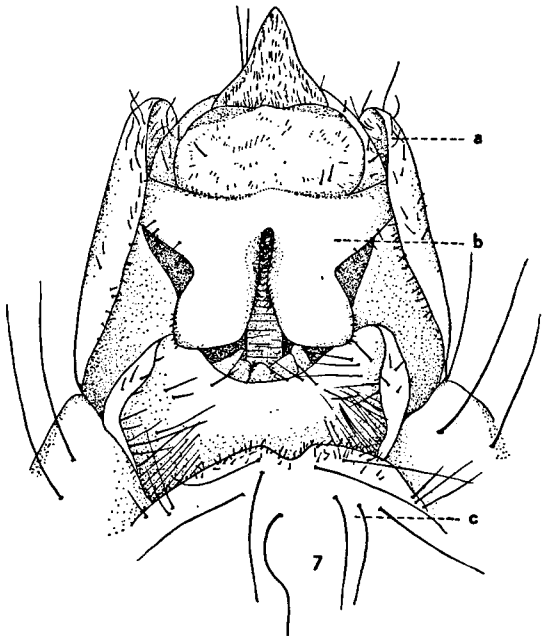

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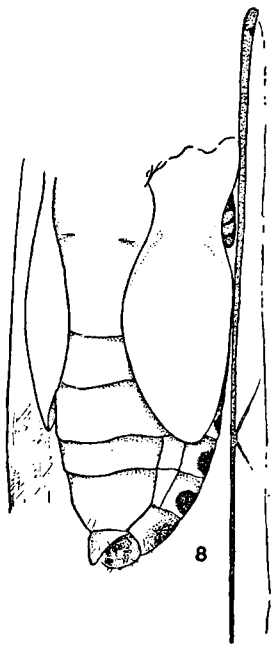

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by some remarks with regard to the correctness of the name *D. vaginata.*

Linnaeus' invalid name *Cicada mannifera* L., 1754, was not used by the author in the tenth edition of the "Systema naturae" or subsequent publications. Apart from Walker's error (1850) of supposing *Cicada mannifera* L., 1754, synonymous with *Cicada tibicen* L., 1758, it was not until 1866 that Stål mentioned the name *Cicada mannifera.* Stål (1866 b) found out that *Cicada mannifera* was identical with *Tettigonia vaginata* Fabricius, 1787. As *C. mannifera* L., 1754, is not an available name, *Dundubia vaginata* (Fabricius) must be used as the correct name for the species.

After examining the type specimens of *D. sobria* Walker, 1850, and *D. immacula* Walker, 1850, in the collection of the British Museum, we can affirm the synonymy of these species with *D. vaginata. Fidicina confinis* Walker, 1868, was erroneously recorded by Distant (1889) and Moulton (1923) respectively, as a synonym of *D. mannifera* and *D. vaginata.* Upon examination of the type of *F. confinis,* a female from Malaya, this species proved to be synonymous with *D. rufivena* Walker, 1850. We have not seen the type of *Cicada virescens* Olivier, 1790.

In his "Monograph of Oriental Cicadidae" Distant (1889) considered *D. terpsichore* (Walker, 1850) a varietal form of *D. mannifera.* For this variety he used the name *D. mannifera* var. *a.* In the description of the figures of this variety, published in 1892, the same form was named *D. mannifera* var. *terpsichore.*

Contrary to Distant's opinion we take Walker's *terpsichore* for a good distinguishable species. Walker's type, a female from East India can easily be distinguished by the outline of the operculum and the shape of the abdomen. The male of *D. terpsichore* differs from the other species of *Dundubia* in the very characteristic sharply pointed opercula.

Apart from Walker's type of *terpsichore,* Distant (1889) recorded two other specimens of *D. mannifera* var. *a.* A male of this form, figured in Distant's monograph (1892: pl. 12 figs. 1, a, b), has rounded opercula as in *D. vaginata.*

In fact we conclude that Distant's specimens of *D. mannifera* var. *a* belong to *D. vaginata* and are not at all related to Walker's *terpsichore.*

Remarks. — Although this species can easily be recognized by the opercula of the male and by the male genitalia, a remarkable individual variability has been found in the structure of these organs. Moreover the species is very variable both in colour and size.

Although we have not succeeded in separating various island forms, we can easily recognize the typical form of *D. vaginata* and the variety *nigrimacula* Walker, 1850. The latter described as *Dundubia nigrimacula* and here treated as a variety of *vaginata* (see p. 39) is mainly distributed on Java and may replace the typical form on this island. The variety *nigrimacula* differs from the typical form in having black spots on the abdomen. In the material from Java at our disposal, only one specimen of the typical form could be found. It may be possible that this specimen was imported from Sumatra or

Borneo and caught in the Javanese harbour Tandjoeng Priok.

The typical form of *D. vaginata*, occurring on Sumatra and Borneo, is very robust and can be recognized in the male sex by the outline of the operculum, of which the lateral margins are hardly sinuate in the basal half (fig. 2).

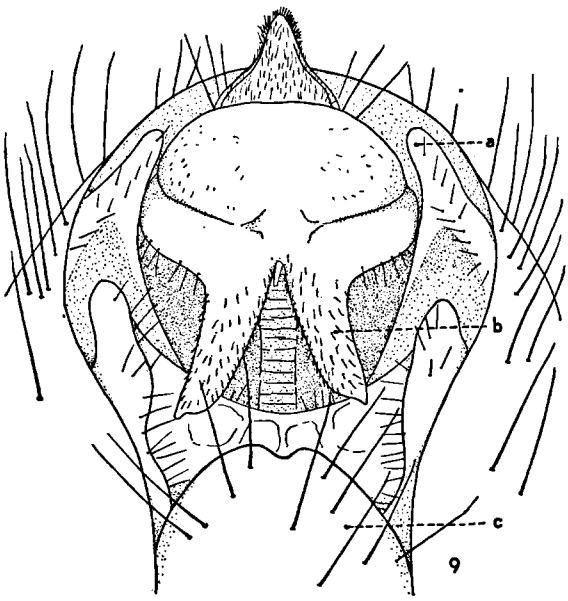
The specimens from the Riouw Archipelago and the Philippines are smaller than the typical form, the opercula are more slender (figs. 4 & 6) and more constricted near the base. The shape of the uncus (figs. 3 & 5) in the male genitalia is slightly different from the structure of the uncus of the typical form (fig. 1).

D. vaginata is rather similar to *D. simalurensis* sp. n. in general appearance. Although the males of *D. vaginata* can easily be separated from *D. simalurensis* by the shape of the operculum and the structure of the uncus, we have not succeeded in finding any differential character between the females of *D. vaginata* and *D. simalurensis*. Nevertheless, we supposed that the females from Simalur, from the same series as the male specimens of *D. simalurensis*, belong to the new species. Moreover this was made very probable because we did not find a male of *D. vaginata* in the material from Simalur.

Dundubia vaginata var. **nigrimacula** Walker, 1850. Figs. 7, 8, 31 & 32.

1850 *Dundubia nigrimacula* Walker, List Hom., **1**: 63.

Material examined. — Java 1 ♂ (type) BM. Java: Ardjasari (Kerkhoven) 1 ♂, RML; Ardjoeno, 1879 (Scheepmaker) 1 ♂, 1 ♀, ZMA; Banjoewangi, 1911 (MacGillavry) 1 ♂, 1 ♀, ZMA; Banjoewangi (MacGillavry) 1 ♀, ZMA; Banjoewangi, Bajoe Kidoel, X.1934 (Mrs. Blom-Koch) 1 ♂, ZMA; Bantoeraden, G. Slamat, 10.IV.1927 (Drescher) 1 ♂, ZMA; Bantoeraden, G. Slamat, 21.X.1928 (Drescher) 1 ♂, ZMA; Buitenzorg, 1892—1893 (R. Semon) 1 ♂, ZMA; Buitenzorg, VI.1922, 1 ♀, RML; Buitenzorg, 23.X.1936 (Dr. J. v. d. Vecht) 1 ♂, RML; Buitenzorg (v. d. Hoeven) 1 ♂, RML; Dampit, Soember Pakel, 1916 (MacGillavry) 2 ♂, 2 ♀, ZMA; Dampit, Soember Pakel, 1919 (MacGillavry) 7 ♂, 6 ♀, ZMA; Dampit, Soember Pakel, 1920 (MacGillavry) 1 ♂, ZMA; East Java, XI.1924, 3 ♂, 1 ♀, BM; Garoet, acq. 1893 (F. Adèr-Ferver) 1 ♀, RML; Garoet, X-XI.1930 (W. C. v. Heurn) 1 ♂, RML; G. Slamat, IV.1917 (Drescher) 3 ♂, ZMA; G. Slamat, IV.1925 (Drescher) 1 ♂, 1 ♀, ZMA; G. Goentoer, III.1915 (Drescher) 1 ♂, ZMA; Hangho Djajar, XII.1921 (MacGillavry) 1 ♀, ZMA; Java, 2 ♂, ZMA; Java, 2 ♂, RML; Java (v. Lansberg) 10 ♂, RML; Java (Reinw[ardt]) 1 ♀, RML; Krawang (L. de V.) 1 ♂, RML; Kendeng ridge, Idjen plateau, XI.1936 (W. C. v. Heurn) 2 ♂, RML; Preanger Djasinga, 5.III.1913 (Mr. M. C. Piepers) 1 ♂, RML; Nongkodjadjar, III.1908 (E. Jacobson) 2 ♀, RML; Nongkodjadjar, I.1911 (E. Jacobson) 2 ♂, RML; Pasoeroean, 1912, 1 ♂, BM; Poedjon, Malang, XI. 1933 (W. C. v. Heurn) 1 ♀, RML; Preanger (J. de Vos tot Nederveen Cappel) 1 ♀, RML; Preanger (Mrs. Adèr) 1 ♂, RML; Preanger (Drescher) 1 ♂, ZMA; Preanger Tjigembong, 1915 (J. B. Corporaal) 1 ♀, ZMA; Preanger (?), 1906 (Beutter) 1 ♂, ZMA; Probolinggo, Bremi, XI.1934 (W. C. v. Heurn) 1 ♂, 1 ♀, RML; Salatiga (P. v. d. Goot) 1 ♀, ZMA; Salatiga, 1 ♀, ZMA; Salatiga, 19.X.1908 (W. D[octers] v[an] L[eeuwen]) 3 ♂, RML; Salatiga, 24.X. 1908 (W. D[octers] v[an] L[eeuwen]) 1 ♀, RML; Salatiga, III.1912 (W. Roepke) 2 ♂, ZMA; Saloppa Tasikmalaja, XI.1949, 1 ♂, RML; Soember Aroem, IV.1914 (Dr. P. Buitendijk) 1 ♂, RML; Soerabaja, 1933—1936 (W. C. v. Heurn) 1 ♀, RML; Soerabaja, 1935 (W. C. v. Heurn) 1 ♂, RML; Soerabaja, 1939 (W. C. v. Heurn) 1 ♀, RML; Tjibadak, VI.1909 (W. C. v. Heurn) 1 ♂, RML; Tjipetir, X.1928 (J. v. d. Vecht) 1 ♀, RML;



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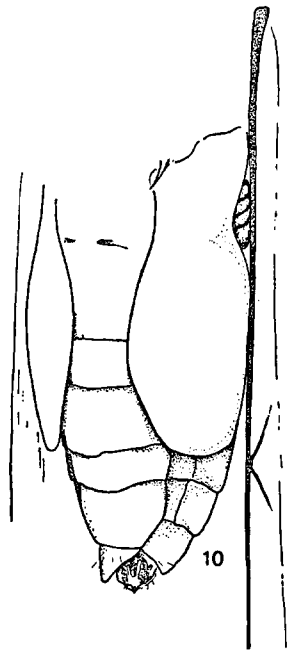

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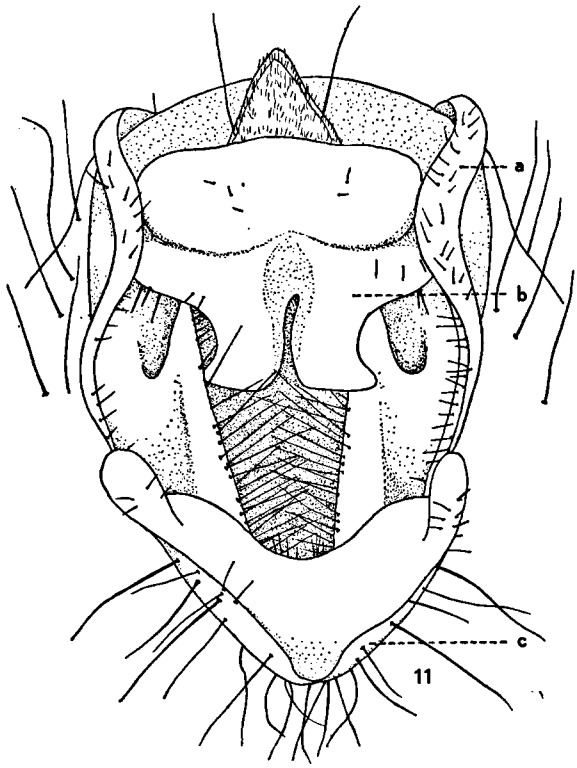

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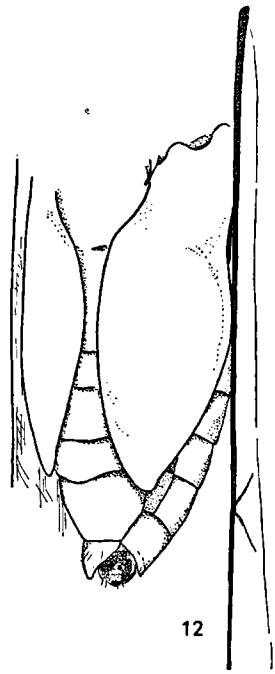

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Wonosobo, V.1909 (E. Jacobson) 1 ♂, ZMA; Wonosobo, 1925 (MacGillavry) 1 ♂, 1 ♀, ZMA; Wijnkoopsbaai, III.1908 (E. Jacobson) 3 ♂, 2 ♀, RML; Sumatra: Deli, Atjeh Widjoenoe (Neeb) 1 ♂, RML; Fort de Kock, X.1913 (E. Jacobson) 2 ♂, RML; Sumatra (Muller) 1 ♂, RML; Sumatra (J. de Vos tot Nederveen Cappel) 1 ♂, RML. Malaya: Butterworth, 28.I.1952 (L. D. Brongersma) 1 ♂, RML; Malaya (v. d. Does de Bije) 2 ♂, RML. China (Van Eyndhoven) 2 ♂, RML. Without locality: "Java or Sumatra" (Dr. Ploem) 1 ♂, ZMA; 10 ♂, 1 ♀, RML; 1 ♂, BM.

Description. — Colour. Head, thorax and abdomen ochraceous to brownish ochraceous or olive-green. Colour variable. The variety *nigrimacula* is very well characterized in both sexes by the rather large black spots on the lateral sides of the third to eighth or fourth to seventh abdominal segments. In the most of the specimens examined hind margins of the sixth to eighth abdominal segments black coloured. Tegmina and wings hyaline or slightly bronze tinged.

Head. Postclypeus twice as broad at its base as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae. Apex of rostrum black.

Operculum. Opercula of the male (fig. 8) resemble very much the opercula of *D. vaginata* from the Philippines (fig. 6), but are more slender than those of the typical form (fig. 2). Opercula reaching the sixth or the seventh abdominal segment. Opercula of the female (fig. 32) broad near to the base, apex obtusely pointed in a lateral direction.

Male genitalia (fig. 7). Shape of the uncus very variable; very much resembling the male genitalia of *D. vaginata.*

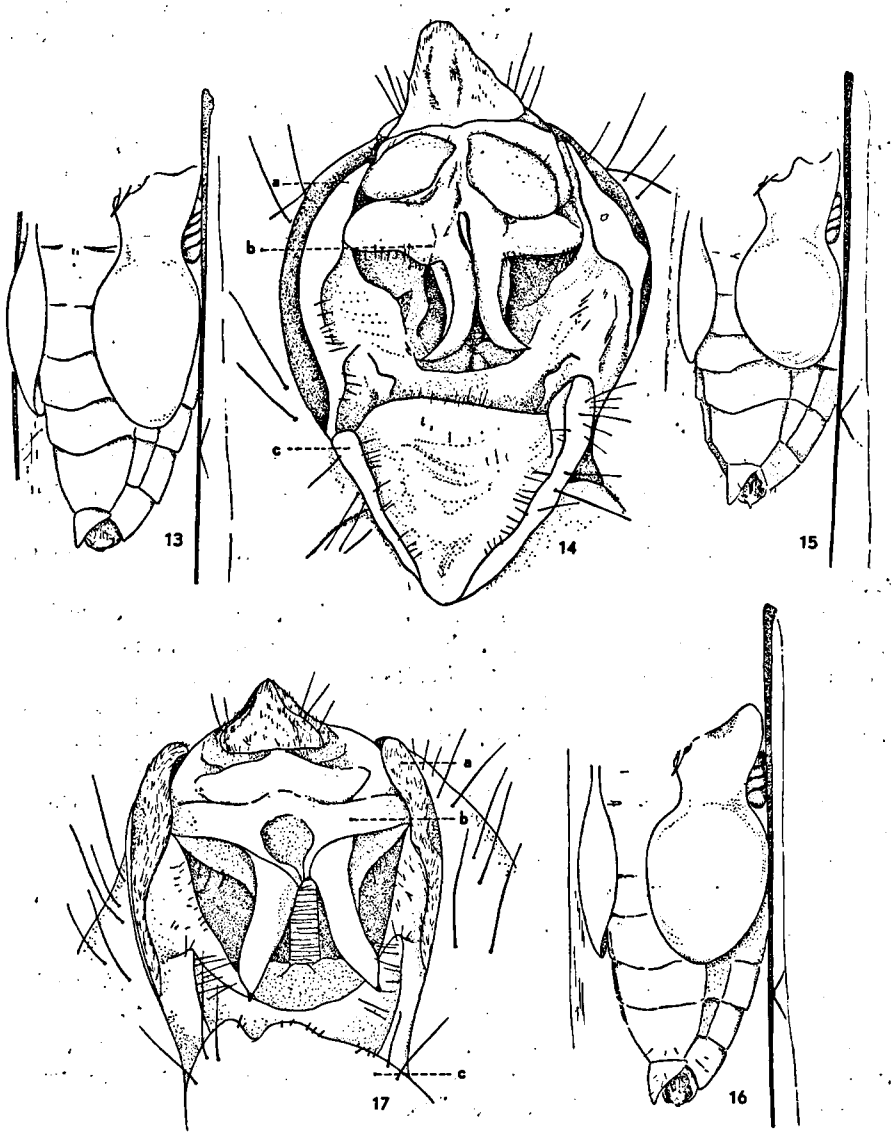
Abdomen of the female (fig. 31). Tip of the abdomen of the female in a lateral aspect hardly curved upwards and rather sharply pointed. Very characteristic black spots on the lateral sides of the abdomen.

Measurements. Male: Length of the body 30.0—40.1 mm, length of tegminum 39.5—46.0 mm, greatest width of head 10.5—12.2 mm, based on 79 specimens. Female: Length of the body 30.4—35.5 mm, length of tegminum 39.6—44.5 mm, greatest width of head 11.0—12.2 mm, based on 17 specimens.

Habitat. — Mainly distributed in Java; in the collections examined also some specimens from Sumatra, Malaya and China.

Synonymy. — Atkinson (1886) synonymized *D. nigrimacula* Walker with *D. mannifera* (L.) (= *D. vaginata* (Fabricius)), and, subsequently, Distant (1906) and Moulton (1923) recognized this synonymy. Although we agree with this view, we prefer to use the variety name *nigrimacula* for the specimens with a strikingly black spotted abdomen.

Figs. 9—10. *Dundubia simalurensis* sp. n., holotype ♂. — 9. Genitalia. a, pygofer; b, uncus; c, sternite VIII. — 10. Abdomen with operculum. — Figs. 11—12. *Dundubia solokensis* sp. n., holotype ♂. — 11. Genitalia. Lettering as in fig. 9. — 12. Abdomen with operculum.



Figs. 13—14. *Dundubia cochlearata* sp. n., holotype ♂. — 13. Abdomen with operculum. — 14. Genitalia. a, pygofer; b, uncus; c, sternite VIII. — Figs. 15—17. *Dundubia rufivena* Walker. — 15. ♂ from Sumatra, Padang, 1926. Abdomen with operculum. — 16. ♂ from North Borneo. Abdomen with operculum. — 17. ♂ from North Borneo. Genitalia. Lettering as in fig. 14.

Dundubia simalurensis sp. n. Figs. 9, 10, 33 & 34.

Material examined. — Sumatra: Island Simalur, Sinabang, III.1913 (E. Jacobson) 1 ♂ (holotype), 1 ♀ (allotype), 6 ♀ (paratypes) RML; same locality, II. 1913 (E. Jacobson) 2 ♀ (paratypes) RML; same locality, IV. 1913, (E. Jacobson) 2 ♂ (paratypes) RML. One ♂ and one ♀ paratype retained for the collection of the Amsterdam Museum.

Description. — Colour. Head, thorax and abdomen very variable in colour, head and thorax green to yellowish, abdomen yellowish green to dark brownish. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at its base as the anterior lateral margins of the vertex. Rostrum passing the intermediate coxae, hardly reaching the posterior coxae. Apex of rostrum black.

Operculum. Operculum of the male (fig. 10) rather broad and reaching the fifth or the sixth abdominal segment. Operculum concavely sinuate on each side near to the middle of the operculum. Apex of the operculum of the female (fig. 34) rounded and directed somewhat laterad.

Male genitalia (fig. 9). Uncus with two rather slender uncus lobes with a pointed apex.

Abdomen of the female (fig. 33). Tip of the abdomen of the female rather sharply pointed, in a lateral aspect hardly curved upwards. In the allotype and some female paratypes small black spots are situated laterally on the hind margins of the tergites of the abdominal segments (fig. 33).

Measurements. Male: Length of the body 36.2—38.7 mm, length of tegminum 42.2 mm, greatest width of head 11.0—11.1 mm, based on 2 specimens. Female: Length of the body 35.2—40.0 mm, length of tegminum 42.5—48.1 mm, greatest width of head 11.2—12.0 mm, based on 9 specimens.

Habitat. — Sumatra: Island Simalur.

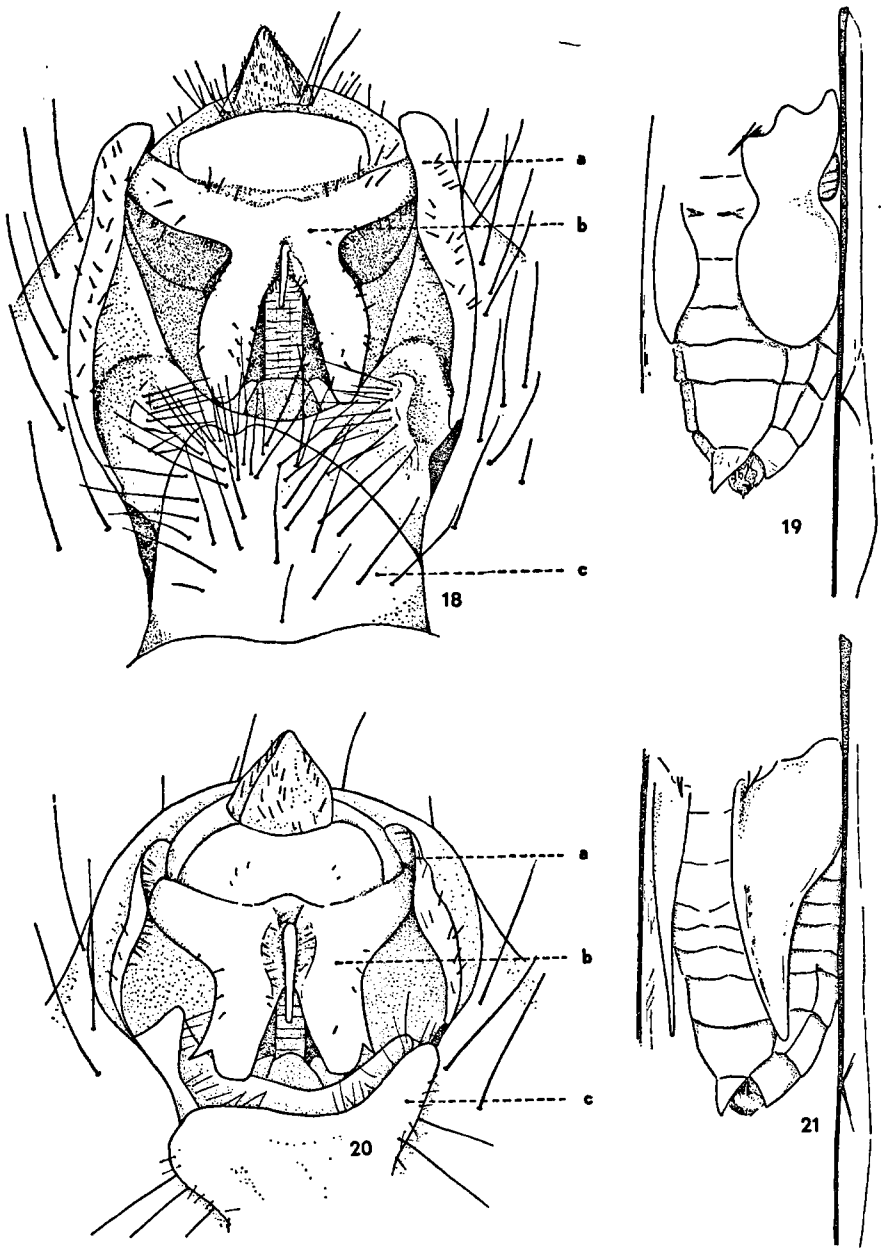
Remarks. — *D. simalurensis* suggests *D. vaginata* in size and general appearance. The male of *D. simalurensis* differs from *D. vaginata* in the shape of the operculum and the uncus.

At the moment it is not possible to distinguish the females of *D. simalurensis* from *D. vaginata*. In the collections studied there is no male specimen of *D. vaginata* from Simalur. Since the females from Simalur are in the same series as the male specimens, it is most probable that these females indeed do belong to *D. simalurensis*.

Dundubia solokensis sp. n. Figs. 11, 12, 35 & 36.

Material examined. — Sumatra, Soerian, Pad[angse] Bovenl[anden] [hills behind Padang], 5.V.1915 (P. O. Stolz) 1 ♂ (holotype) RML; Sumatra, Solok, 26.VI.1913 (P. O. Stolz) 1 ♀ (allotype) RML; Sumatra, Solok, Padangse Bovenlanden, acq. 1911 (P. O. Stolz) 2 ♂, 1 ♀ (paratypes) RML; same locality, 22.I.1915 (P. O. Stolz) 1 ♂ (paratype) RML. One ♂ paratype retained for the Amsterdam Museum.

Description. — Colour. Head, thorax and abdomen bright green, one paratype yellowish, without markings on the body. Tegmina and wings hyaline. In all the specimens the tegmina and wings are somewhat crumpled.



Figs. 18—19. *Dundubia rafflesii* Distant, ♂ from Java, Batavia, X.1907. — 18. Genitalia. a, pygofer; b, uncus; c, sternite VIII. — 19. Abdomen with operculum. Figs. 20—21. *Dundubia terpsichore* Walker, ♂ from Sumatra, between Serdang and the Tobalake. — 20. Genitalia. Lettering as in fig. 18. — 21. Abdomen with operculum.

Head. Postclypeus twice as broad at the base as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae. Apex of rostrum black.

Operculum. Operculum of the male (fig. 12) of a very characteristic shape. Operculum constricted at its base, medial margin rather convex, lateral margin less convex. Apex sharply pointed, reaching the seventh or eighth abdominal segment, apical part directed somewhat laterad. Operculum of the female (fig. 36) obtusely pointed in a lateral direction.

Male genitalia (fig. 11). The uncus bears two short lobes widening towards the truncate apex.

Abdomen of the female (fig. 35). Tip of the abdomen rather obtuse, curved upwards in a lateral aspect. The female abdomen resembles that of *D. rufivena.*

Measurements. Male: Length of the body 32.0—37.7 mm, length of the tegminum about 45 mm, greatest width of head 11.7—12.0 mm, based on 4 specimens. Female: Length of the body 32.4—35.1 mm, length of the tegminum about 45 mm, greatest width of head 11.9—12.0 mm, based on 2 specimens.

Habitat. — Padangse Bovenlanden [Hills behind Padang], Sumatra.

Remarks. — The shape of the uncus of *D. solokensis* is quite distinct, so that the species can be confused with no other known species of *Dundubia.* The female of *D. solokensis* bears a close resemblance to the female of *D. vaginata,* but the distinction is rather easy on account of the shape of the abdomen. Furthermore, *D. solokensis* suggests *D. rufivena* in the shape of the female abdomen, but differs in size and structural characters of the male opercula and genitalia.

Dundubia cochlearata sp. n. Figs. 13 & 14.

Material examined. — Sumatra, S. E. coast, Laut Tador, 14.III.1951 (R. Straatman) 1 ♂ (holotype) RML; same locality, 10.IV.1951 (R. Straatman) 1 ♂ (paratype) RML; Padangse bovenlanden [Hills behind Padang] (J. Menzel) 1 ♂ (paratype) RML; Pager Alang (J. J. de Vos tot Nederveen Cappel) 1 ♂ (paratype) RML; Sumatra (J. J. de Vos tot Nederveen Cappel) 1 ♂ (paratype) RML; Sumatra (Ludeking) 1 ♂ (paratype) RML; Tandj. Andalas (E. Jacobson) 2 ♂ (paratypes) RML. One paratype retained for the Amsterdam Museum.

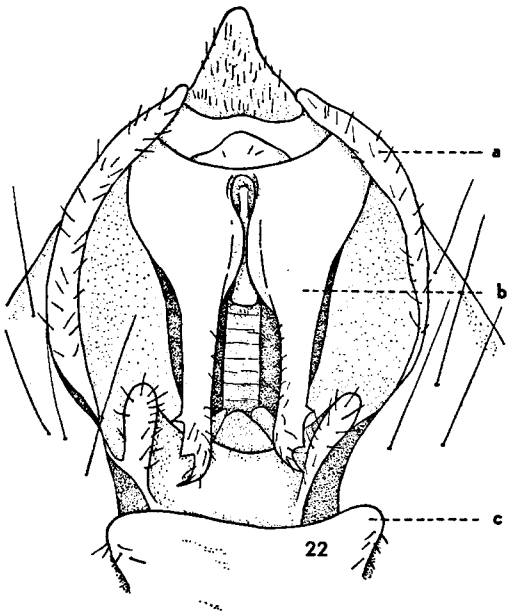
Description. — Colour. Head, thorax and abdomen ochraceous or brownish ochraceous to green. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at its base as the anterior lateral margins of the vertex. Rostrum passing the intermediate but not reaching the posterior coxae.

Operculum (fig. 13). Operculum spoon-shaped, rather long, reaching the sixth or the seventh abdominal segment.

Male genitalia (fig. 14). Uncus with two narrow lobes. Apex of the uncus lobe sharply pointed and curved somewhat laterad.

Measurements. Male: Length of the body 37.1—39.4 mm, length of tegmi-



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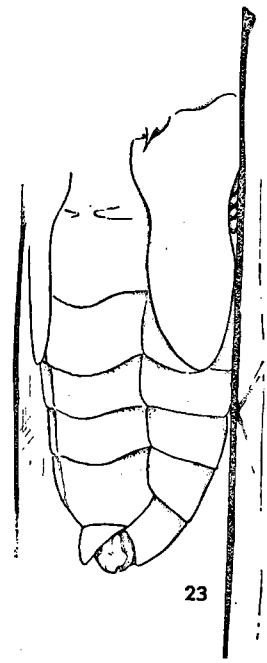

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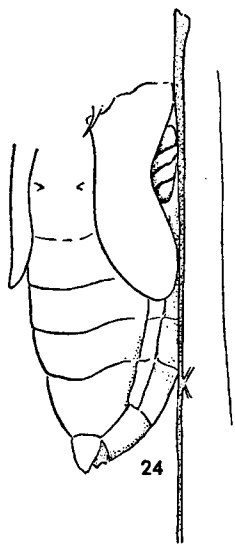

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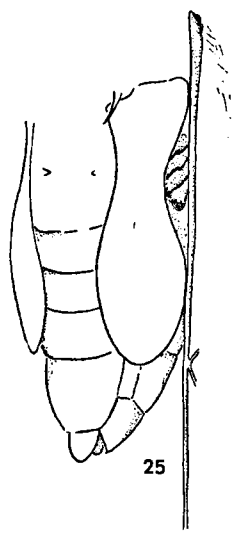

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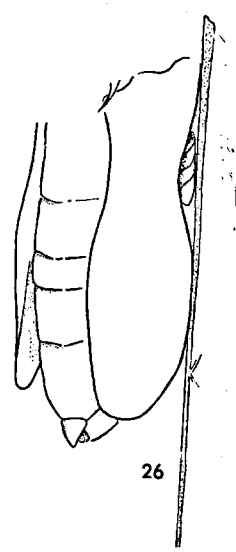

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num 44.0—45.9 mm, greatest width of head 11.0—11.1 mm, based on 8 specimens.

Female unknown.

Habitat. — Sumatra.

Remarks. — *D. cochlearata* is rather close to *D. vaginata* but the narrow uncus lobes and the spoon-shaped opercula of the male are features of distinction. Apparently there was no female in the collection of the Leiden Museum. It seems possible that the female of *D. cochlearata* resembles so much the female of *D. vaginata,* that we were unable to identify the female sex of the newly described species.

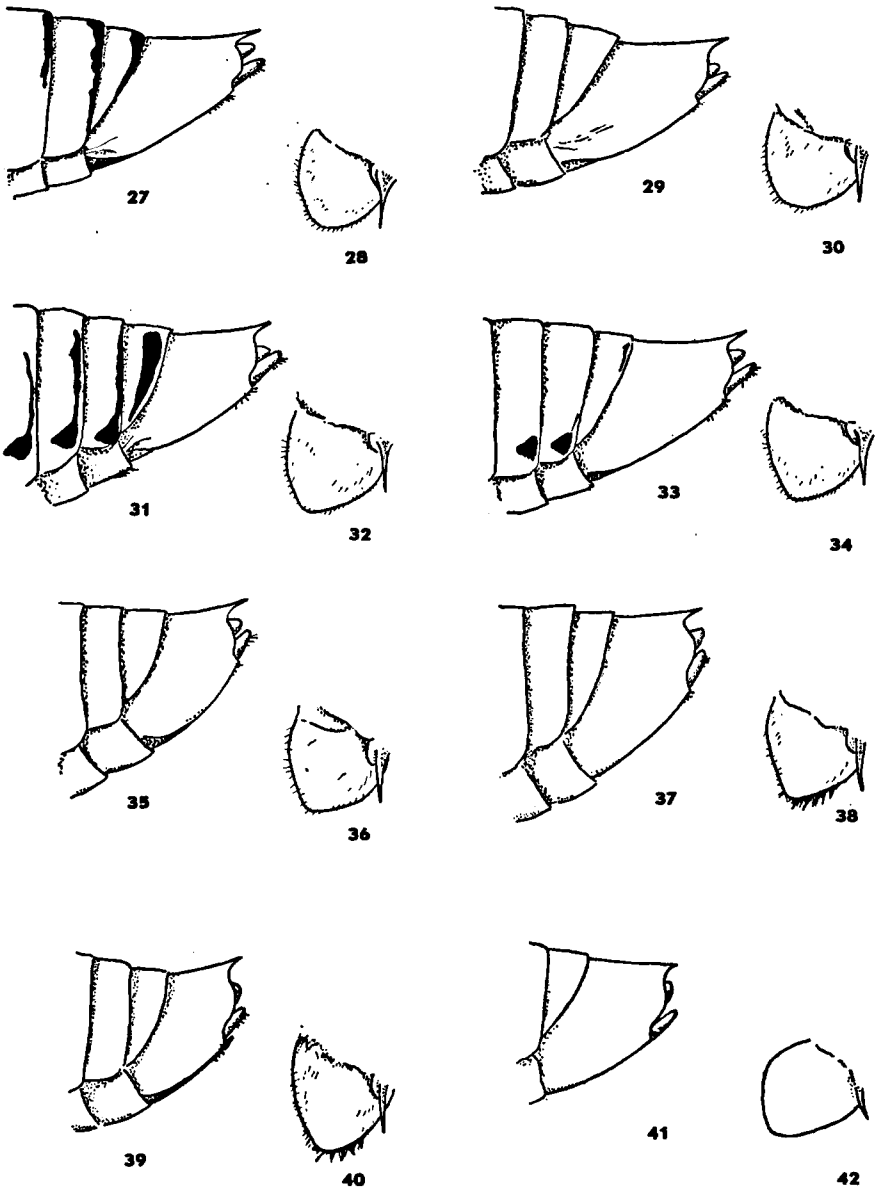
The spoon-shaped male opercula of *D. cochlearata* suggest relation to the smaller *D. rufivena,* but the new species can be separated from *rufivena* by the difference in size and the characteristic structure of the male genitalia.

Dundubia rufivena Walker, 1850. Figs. 15—17 & 37—42.

1850 *Dundubia rufivena* Walker, List Hom., **1**: 59.
1856 *Dundubia intemerata* Walker, J. Linn. Soc., (Zool.) **1**: 84.
1868 *Fidicina confinis* Walker, J. Linn. Soc., (Zool.) **10**: 92.
1889 *Dundubia mellea* Distant, Monogr. Orient, Cicad. part 2: 40.
1892 *Dundubia mellea* Distant, loc. cit. part 5: pl. 12 fig. 9, a, b.

Material examined. — Java, 1 ♂ (type of *D. rufivena)* BM; Singapore (Wallace) 1 ♀ (type of *D. intemerata)* BM; Borneo, 1 ♂ (type of *D. mellea)* BM; Malaya, Penang, 1 ♀ (type of *Fidicina confinis)* BM. Java: Java (M. R. Bely) 1 ♂, BM; Java 1 ♂, ZMA; Java (Mr. M. G. Piepers) 1 ♀, RML; Buitenzorg, 27.VIII.1937 (J. v. d. Vecht) 1 ♀, RML; Tjilatap, III.1928 (Drescher) 1 ♀, ZMA; Tjipongpok, 1923 (Kerkhoven) 1 ♂, ZMA. Sumbawa: Sumbawa (v. Lansberg) 1 ♀, RML. Borneo: Berangas, XI.1930 (J. van der Vecht) 1 ♀, RML; Borneo, 3.IV.1903 (M. C. Piepers) 3 ♀, RML; Borneo (Schwaner) 1 ♂, 1 ♀, RML; Borneo (Muller) 1 ♂, RML; Borneo, 1 ♀, RML; Bloe-oe, Upper Mahakkam, 1898 (Dr. Nieuwenhuis) 1 ♀, RML; Bloe-oe, 18.IX.1894 (Dr. Nieuwenhuis) 2 ♀, RML; Elopura, III.1884, 3 ♂, 1 ♀, BM; Long Bloe-oe, XI.1898 (Dr. Nieuwenhuis) 1 ♀, RML; Long Bloe-oe, XII.1898 (Dr. Nieuwenhuis) 1 ♀, RML; Long Nawang, 1925 (Mjöberg) 13 ♀, ZMA; Madang Ro, 22.III.1909, 1 ♀, RML; Madang Ro, 23.III.1909, 1 ♀, RML; Mahakkam, 1894 (Dr. Nieuwenhuis) 3 ♀, RML; Mahakkam, Long Bloe-oe, 2.XI.1898 (Dr. Nieuwenhuis) 2 ♀, RML; North Borneo, 1919 (acq. Staudinger) 1 ♂, ZMA; North Borneo, 1 ♀, RML; Pegatan, 16.XI.1930 (J. v. d. Vecht) 1 ♀, RML; Poetoes Sibau, 30.XI.1893 (Büttikofer) 1 ♀, RML; Poetoes Sibau, 30.XI. 1893 (Max Moret) 1 ♀, RML; Pontiak (Max Weber) 4 ♀, RML; Sambas, 1891 (Dr. J. Bosscha) 2 ♂, 3 ♀, RML; Sambas, V.1890 (Mr. Lucassen) 1 ♀, RML; Sangau Kapuas, 1894 (Westenink) 1 ♀, RML; S. E. Borneo, 1 ♀, BM; Sintang, 1894, 1 ♀, RML; Smitau (Büttikofer & Velthuyzen) 1 ♀, RML; Smitau, I.1894 (Dr. J. Büttikofer) 1 ♀, RML; Smitau, 6.XI.1893 (Max Moret) 1 ♀, RML; Smitau, 12. XI.1893 (Max Moret) 1 ♀, RML; Smitau, 5.XI.1894 (Max Moret) 1 ♂, RML; Smitau, 4.XII.1894

Figs. 22—23. *Dundubia aerata,* Distant, ♂ from Borneo, Mahakkam. — 22. Genitalia. a, pygofer; b, uncus; c, sternite VIII. — 23. Abdomen with operculum. — Fig. 24. *Dundubia emanatura* Distant, type ♂. Abdomen with operculum. — Fig. 25. *Dundubia helena* Distant, type ♂. Abdomen with operculum. — Fig. 26. *Dundubia longina* Distant, type ♂. Abdomen with operculum.



Figs. 27—30. *Dundubia vaginata* (Fabricius). — 27. ♀ from Sumatra, Tandj. Andalas. Tip of abdomen. — 28. The same. Operculum. — 29. ♀ from Philippines, Surigao, Mindanao. Tip of abdomen. — 30. The same. Operculum. — Figs. 31—32. *Dundubia vaginata* var. *nigrimacula* Walker. ♀ from Java, Dampit, Soember Pakel, 1919. — 31. Tip of abdomen. — 32. Operculum. — Figs. 33—34. *Dundubia simalurensis* sp. n. Allotype ♀. — 33. Tip of abdomen. — 34. Operculum. — Figs. 35—36. *Dundubia*

(Max Moret) 1 ♂, RML; Tarakan, 2.VI.1932 (H. Boschma) 1 ♀, RML; Tawau, V.1939 (A. Mulders) 1 ♀, RML. Sumatra: Airbangis, XI.1913 (E. Jacobson) 3 ♀, RML; Balim, Padangse Bovenlanden [Hills behind Padang], VI.1914 (E. Jacobson) 1 ♀, RML; Balim, Undra Labusum, VII.1914 (E. Jacobson) 1 ♀, RML; Bekri, Deli (Pantekoek) 1 ♀, RML; Belawan, III.1928 (P. Buitendijk) 2 ♂, RML; Belawan, VIII.1928 (P. Buitendijk) 1 ♂, 1 ♀, RML; Belawan, Deli, II.1929 (P. Buitendijk) 1 ♂, RML; Belawan, VII. 1930 (P. Buitendijk) 1 ♀, RML; Belawan, X.1930 (P. Buitendijk) 1 ♀, RML; Belawan, 3.I.1936 (J. Bremer) 1 ♂, RML; Benkoelen, Tambang Sawak, 1929 (E. Douglas) 1 ♀, ZMA; Bindjei, 1-20.XI.1935 (A. v. d. Heyde) 1 ♂, ZMA; Boengoemas (J. C. v. Hasselt) 5 ♀, RML; Boengoemas, Palembang (A. L. v. Hasselt) 1 ♂, RML; Boengoemas (A. L. v. Hasselt) 1 ♀, RML; Buo, Padangse Bovenlanden [Hills behind Padang] (E. Jacobson) 1 ♀, RML; Deli, 29.XII.1904 (R. v. Prehn Wiese) 1 ♂, 1 ♀, RML; Deli (De Bussy) 1 ♂, RML; Deli (D. v. d. Hoop) 1 ♀, RML; Dolok Merangir (H. C. v. Eldik) 1 ♂, RML; Fort de Kock, X.1913 (E. Jacobson) 1 ♂, RML; Fort de Kock, II.1914 (E. Jacobson) 1 ♀, RML; Fort de Kock, 1921 (E. Jacobson) 1 ♀, BM; Fort de Kock, 1924 (E. Jacobson) 1 ♀, RML; Fort de Kock, 1925 (E. Jacobson) 1 ♂, RML; Fort de Kock, 1926 (E. Jacobson) 1 ♂, 1 ♀, BM, 1 ♀, ZMA; Goenoeng Sahilan, 1907 (Dr. Zwaan) 1 ♀, ZMA; Indragiri, 1893-1894 (v. Hasselt) 1 ♂, RML; Indrapoera, 1 ♂, 1 ♀, RML; Lahat, 1875 (Giesberts) 1 ♀, ZMA; Lahat, 10.II.1948 (W. C. Verboom) 1 ♀, RML; Laut Tador, 14.III.1951 (R. Straatman) 2 ♀, RML; Laut Tador, 4.IV.1951 (R. Straatman) 2 ♂, RML; Ledong Donok, IX.1909 (Abdul Rachman) 2 ♀, RML; Loeboe Bankoe, V. 1905 (J. Menzel) 4 ♀, RML; Medan, III.1910 (De Bussy) 1 ♀, ZMA; Medan (De Bussy) 1 ♀, ZMA; Medan, 6.I.1921 (J. B. Corporaal) 1 ♂, ZMA; Moera Laboe, 1 ♀, RML; Padang, Deli, 1895 (E. Büttikofer) 2 ♀, RML; Padang, Deli (E. Büttikofer) 2 ♀, RML; Padang, Deli (E. Büttikofer) 2 ♂, RML; Padang, 1922 (J. J. de Groot) 1 ♀, ZMA; Padang, 1926 (E. Jacobson) 1 ♂, ZMA; Padangse Bovenlanden, Sawah Loentoe (Miss Delprat) 2 ♀, RML; Padang (V[an] Bemm[el]) 1 ♀, RML; Padang (H. W. v. d. Velde) 1 ♀, RML; Padang, 1 ♀, RML; Palembang (MacGillavry) 1 ♀, ZMA; Pladjoe, 1923-1925 (Ir. P. v. Hemert) 2 ♀, RML; Puluh Weh, III. 1911 (Buitendijk) 1 ♀, ZMA; Poeloe Tella (A. L. v. Hasselt) 1 ♀, RML; Sawahanogung, VII.1915 (E. Jacobson) 1 ♂, RML; Serdang (v. Leeuwen) 1 ♂, 5 ♀, RML; Between Serdang and Tobalake (Dr. B. Hagen) 1 ♂, RML; Sibolangit, 1917 (J. A. Loerning) 1 ♂, RML; Sibolangit, 4.I.1955 (J. v. d. Vecht) 1 ♂, 2 ♀, RML; Sidempoean, Tapanoeli, 1894 (A. L. v. Hasselt) 3 ♀, RML; Silago, 3 ♀, RML; Soerian, 2 ♀, RML; Soeroelangoen, 1 ♀, RML; Solok, 9.V.1910 (P. O. Stolz) 1 ♀, RML; Solok, 2.VI.1913 (P. O. Stolz) 1 ♀, RML; Solok, Padangse Bovenlanden, 1908 (P. O. Stolz) 1 ♀, RML; Solok, Padang (P. O. Stolz) 2 ♀, RML; Sumatra (Sir S. Raffles) 1 ♂, BM; Sumatra 1 ♀, BM; Sumatra, 1914 (A. Weiss) 3 ♀, ZMA; Sumatra (Ludeking) 1 ♂, RML; Sumatra (Muller) 1 ♂, RML; Sumatra's Oostkust, 1930 (Miss Scheffer) 1 ♀, ZMA; Taloek, 1907 (Dr. J. Zwaan) 3 ♀, ZMA; Tapanoeli (v. Lansberg) 3 ♀, RML; Tandjoeng, Moeara Enim, 1924 (E. Douglas) 1 ♀, ZMA; Tandjong Merah, 18.XII.1918 (J. B. Corporaal) 1 ♀, ZMA; Tebing Tinggi (F. J. Wenman) 1 ♂, RML; Mentawei, 1894 (Modigliani) 1 ♂, BM. Simalur: Sinabang, II.1913 (E. Jacobson) 4 ♀, RML; Sinabang, VII.1913 (E. Jacobson) 1 ♀, RML. Banka: Banka (Buddingh) 2 ♀, RML; Banka, XI.1885 (Vosmaer) 3 ♀, RML. Riouw Archipel: Riouw, 1901 (Kluit) 3 ♀, ZMA. Nias: Nias, 1 ♂, BM; Nias, 2 ♂, RML; Nias, 1911 (Kleiweg de Zwaan) 1 ♂, 1 ♀, RML; Nias, 1908 (E. E. W. G. Schröder) 3 ♂, 6 ♀, RML. Malaya: Perak, 1 ♀, BM.

solokensis sp. n. Paratype ♀ from Sumatra, Solok. — 35. Tip of abdomen. — 36. Operculum. — Figs. 37—40. *Dundubia rufivena* Walker. — 37. ♀ from Borneo, Long Nawang. Tip of abdomen. — 38. The same. Operculum. — 39. ♀ from Sumatra, Padang, 1926 (E. Jacobson). Tip of abdomen. — 40. The same. Operculum. — Figs. 41—42. *Dundubia rufivena* Walker (= *D. intemerata*, type) ♀ from Singapore. — 41. Tip of abdomen. — 42. Operculum.

Siam: Bangkok, 1924 (Maj. H. G. Bigg. Withes) 1 ♂, BM. Celebes, 1869 (coll. Heylaerts) 1 ♀, RML. Locality unknown: Ind. Or. Archipelago, 1 ♀, ZMA; Borneo?, 1909 (Hagendoorn) 1 ♀, ZMA; (coll. MacGillavry) 1 ♂, 1 ♀, ZMA; 9 ♀, RML.

Description. — Colour. Head, thorax and abdomen bright green to dark ochraceous. Colour very variable. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at its base as the anterior lateral margins of the vertex. Rostrum passing the intermediate coxae, in some specimens reaching the posterior coxae. Apex of rostrum brownish to black.

Operculum. Opercula of the male (figs. 15 & 16) spoon-shaped. Apical part of the operculum one and a half to two times as broad as the base. Male operculum extending to the fifth or the sixth abdominal segment. Opercula of the female (figs. 38, 40 & 42) obtusely pointed in a lateral direction.

Male genitalia (fig. 17). The uncus bears two stick-shaped, acutely pointed uncus lobes.

Abdomen of the female (figs. 37, 39 & 41). Tip of the abdomen rather blunt, curved upwards in a lateral aspect.

Measurements. This species is most variable in size. We have not succeeded in separating various island forms on account of the size of body and tegmina. Male: Length of the body 21.2—33.6 mm, length of tegminum 30.0—40.2 mm, greatest width of head 7.5—10.8 mm, based on 170 specimens. Female: Length of the body 23.0—34.5 mm, length of tegminum 29.0—41.0 mm, greatest width of head 7.0—10.6 mm, based on 51 specimens.

Habitat. — A very common species distributed throughout the Malay Archipelago from Malaya to New Guinea.

Synonymy. — As a result of the examination of Walker's type of *D. intemerata* Walker, 1856 — a female from Singapore — we can confirm Moulton's conclusion (1923) that this type belongs to *D. rufivena* Walker, 1850. In consequence the junior name *D. intemerata* Walker, 1856, falls as a synonym of *D. rufivena*. Unfortunately Moulton (1923) erroneously preserved the name *D. intemerata* for a male of this species subsequently recorded from Sarawak by Walker (1857) and designated this specimen as a "type" for *D. intemerata*.

During our study of the material of the genus *Dundubia* in the British Museum, we have not come across Walker's male specimen of *D. intemerata* from Sarawak. From Moulton's description (1923) of the very peculiar shape of the male operculum, we can conclude without hesitation that this male specimen of *D. intemerata* Walker [sensu Moulton, 1923] belongs to *D. terpsichore* Walker.

Moulton (1923) also synonymized *D. mellea* Distant, 1889, with *D. rufivena*. In his description Distant expressed his doubt about *D. mellea* as a distinguishable species: "I was first inclined to consider this form, from its distinctive coloration, as an undescribed species, but have since found other specimens from Northern Borneo of so intermediate a character, that I have preferred keeping it for present as a subspecies or a simple variety of

D. rufivena. Should the last supposition prove correct, we have in *D. rufivena* a species which not only varies in colour, but also much more largely in size".

Studying the large material at our disposal we did not find appreciable distinctive characters in the shape of the opercula and the male genitalia for separating *D. rufivena* and *D. mellea*. In our opinion *D. mellea* is a robust form of *D. rufivena*. Therefore we can confirm the synonymy of these species proposed by Moulton (1923).

The type of *D. confinis*, a female from Malaya, has the characteristic abdomen of the female *rufivena*. We incline to the view that *D. confinis* is a synonym of *D. rufivena*, and not of *D. vaginata* as suggested by Distant (1889) and Moulton (1923).

Remarks. — This variable species looks rather similar to *D. vaginata* in colour and general appearance but the smaller size, the peculiar shape of the opercula of the male and the blunt outline of the abdomen of the female of *D. rufivena* will help in separating it from *D. vaginata*. For the difference with *D. rafflesii* the reader is referred to the remarks under the last species.

Dundubia rafflesii Distant, 1883. Figs. 18, 19, 43 & 44.

1883 *Dundubia rafflesii* Distant, Proc. zool. Soc. Lond., **1883**: 188.

Material examined. — Java, 1 ♂ (type) BM. Java: Batavia, IX.1907 (E. Jacobson) 1 ♂, ZMA; Batavia, X.1907 (E. Jacobson) 1 ♀, ZMA; same data, 1 ♂, 2 ♀, RML; Batavia, X.1908 (E. Jacobson) 1 ♂, BM; same data, 2 ♀, RML; Batavia, 5.XII.1912 (Dr. P. Buitendijk) 1 ♂, RML; Banjoewangi, 1911 (MacGillavry) 1 ♂, 1 ♀, ZMA; Garoet, 1928 (W. C. v. Heurn) 5 ♂, 8 ♀, RML; Garoet, X-XI.1930 (W. C. v. Heurn) 1 ♂, RML; Garoet, 1935. (W. C. v. Heurn) 1 ♂, RML; Pradjekan, Pantjoer, 1932 (Blom) 1 ♀, ZMA; Java (Mr. M. G. Piepers) 1 ♀, RML; Java, 1924-1927 (W. C. v. Heurn) 1 ♀, RML; Malaya (Van der Does de Bije) 1 ♀, RML.

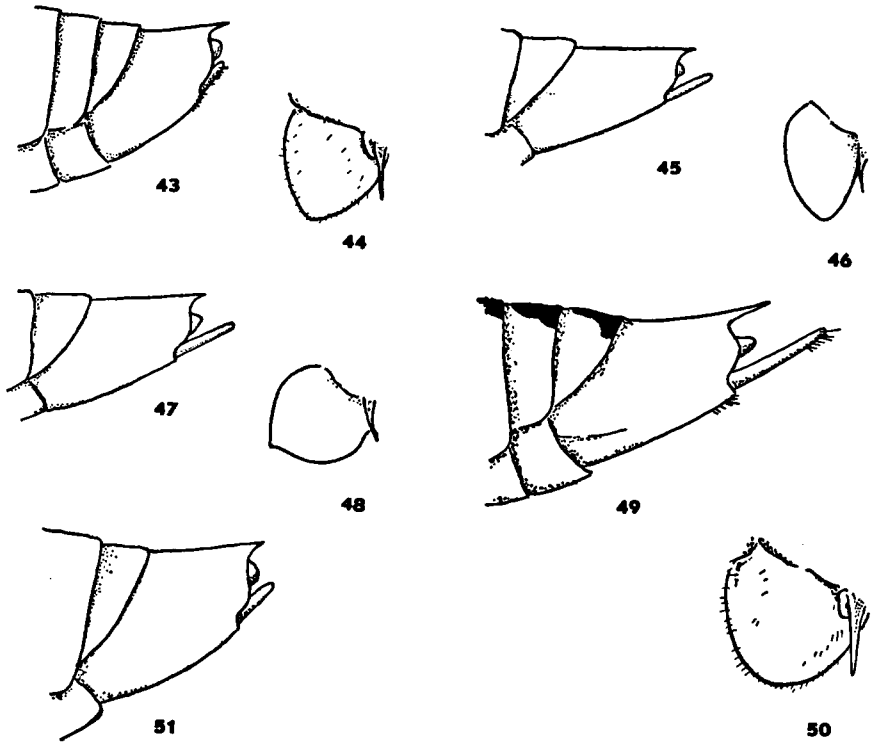
Description. — Colour. Head, thorax and abdomen greenish ochraceous to dark brown, with a small median black spot on the pronotum, in front of the pronotumcollar, and two converging paramedian black lines on the mesonotum. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at the base as the anterior lateral margins of the vertex. The relatively long rostrum extends to the anterior margin or the middle of the posterior coxae. Apex of rostrum brownish to black.

Operculum. Apical part of the male operculum (fig. 19) as broad as the base. The operculum is constricted at one third from the base, and then widened towards the rounded apical part. Operculum reaching the fifth or the sixth abdominal segment. Operculum of the female (fig. 44) obtusely pointed in a lateral direction.

Male genitalia (fig. 18). The uncus bears two rather slender uncus lobes with rounded apices.

Abdomen of the female (fig. 43). Tip of the abdomen of the female in a lateral aspect hardly curved upwards; the shape is intermediate between that



Figs. 43—44. *Dundubia rafflesii* Distant. ♀ from Java, Banjoewangi. — 43. Tip of abdomen. — 44. Operculum. — Figs. 45—46. *Dundubia terpsichore* Walker. Type ♀. — 45. Tip of the abdomen. — 46. Operculum. — Figs. 47—48. *Dundubia emanatura* Distant. ♀ from India, Nilgiris. — 47. Tip of abdomen. — 48. Operculum. Figs. 49—50. *Dundubia aerata* Distant. ♀ from Borneo, Mahakkam. — 49. Tip of abdomen. — 50. Operculum. — Fig. 51. *Dundubia longina* Distant. ♀ from Tonkin. Tip of abdomen.

of the female abdomina in *D. vaginata* and *D. rufivena.*

Measurements. Male: Length of the body 25.5—30.7 mm, length of tegminum 32.0—36.8 mm, greatest width of head 9.0—10.0 mm, based on 12 specimens. Female: Length of the body 26.5—30.0 mm, length of tegminum 35.4—38.8 mm, greatest width of head 9.9—10.5 mm, based on 17 specimens.

Habitat. — Only known from Java and Sumatra. The collection of the Leiden Museum contains one female from Malaya.

Remarks. — *D. rafflesii* is related to the preceding species from which it differs in both sexes by the presence of the black mesonotum lines. Moreover, the male of *D. rafflesii* can easily be distinguished by the shape of the operculum which has the same width at the base and at the apex, whereas the operculum of *D. rufivena* is one and a half to two times broader at the apex than at the base. Moreover the male genitalia are very characteristic.

The distinction of the females of the two species may be rather difficult. Dark specimens do not show clearly the absence or presence of the black mesonotum lines. The dark coloured females of *D. rafflesii* can be recognized, however, by the shape of the abdomen.

Dundubia terpsichore (Walker, 1850). Figs. 20, 21, 45 & 46.

1850 *Cephaloxys terpsichore* Walker, List Hom., **1**: 239.
nec 1889 *Dundubia mannifera* var. *a* Distant, Monogr. Orient. Cicad. part 2: 39.
nec 1892 *Dundubia mannifera* var. *terpsichore*; Distant, loc. cit. part 5: pl. 12 fig. 1, a, b.
1889 *Dundubia intemerata*; Distant, loc. cit. part 2: 42, pl. 4 fig. 1, a, b.
1923 *Dundubia intemerata*; Moulton, J. fed. Malay Mus., **11**: 85.

Material examined. — East India, 1 ♀ (type of *Cephaloxys terpsichore*) BM. India: North Khasia (Chenell) 1 ♂, BM; Moclai, 1 ♀, BM; Silhet, 1 ♂, BM. French Laos: Ban Laham, 1920 (J. F. Godfrey) 2 ♂, 4 ♀, BM. Burma, Raia Hills (Doherty) 1 ♂, BM. Indo-China: Luang Prabang, 1920 (R. V. de Salvaza) 1 ♂, 2 ♀, BM; Tonkin, 1917 (R. V. de Salvaza) 1 ♀, BM. Tenasserim, Myitta in the Valley (Doherty) 1 ♂, BM. Sumatra, Between Serdang and the Tobalake (Dr. B. Hagen) 1 ♂, RML. Without locality: 1 ♂, BM.

Description. — Colour. Head, thorax and abdomen green to bright ochraceous; without black markings on the body. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at its base as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae. Apex of rostrum black.

Operculum. Operculum of the male (fig. 21) reaching the seventh abdominal segment. Basal half of the operculum rather broad, apical part tapering to the sharply pointed tip of the operculum. Shape of the male operculum as in *D. kebuna* Moulton. Operculum of the female (fig. 46) with a rather sharp point; apex of operculum directed mesad.

Abdomen of the female (fig. 45). Tip of the abdomen in a lateral aspect hardly curved upwards and very sharply pointed. Ovipositor rather long.

Male genitalia (fig. 20). The uncus bears two rather broad lobes each provided with a very characteristic sharp point on the lateral margins.

Measurements. According to Distant (1889): Male: length of the body 28—30 mm, expansion tegmina 78—85 mm. Female: length of the body 26—28 mm, expansion tegmina 74—78 mm.

Habitat. — India, Burma, Indo-China, Tenasserim and Sumatra.

Synonymy. — The quite unique outline of the opercula of the type of *D. terpsichore*, a female from East India, will easily separate this species from the other species of the genus. The shape of the abdomen is an other distinctive character. We have compared the type of *D. terpsichore* with the females in two rather small series from French Laos and Indo-China in the collection of the British Museum. On account of the above-mentioned characters of the female these specimens proved to be identical with the type of *terpsichore*.

The males from the same localities in French Laos and Indo-China are

very similar among themselves and are very well characterized by the sharply pointed opercula (fig. 21). There can be little doubt that they belong to *D. terpsichore.*

Although Moulton (1923) concluded rightly that Walker's female type of *intemerata* belongs to *D. rufivena* (see p. 47), he preserved erroneously the name *D. intemerata* for a male of this species from Sarawak, which was designated as a new "type" for the species. From the figures in Distant's "Monograph of Oriental Cicadidae" and Moulton's description (1923) of the very peculiar shape of the male opercula of *D. intemerata,* we conclude that these male specimens of *D. intemerata* belong to *D. terpsichore.*

In the discussion on the synonymy of *D. vaginata* (see p. 36) we established that Distant's specimens of *D. mannifera* var. *terpsichore* Walker (= *D. mannifera* var. *a*) belong to *D. vaginata.*

Remarks. — Although the shape of the abdomen of the female of *D. terpsichore* resembles that of *D. emanatura* and *D. aerata,* the last two species are easily distinguished by the black markings on the head and their larger size.

For a discussion on the differences between *D. terpsichore* and *D. kebuna* the reader is referred to *D. kebuna.*

Dundubia kebuna Moulton, 1923

1923 *Dundubia kebuna* Moulton, J. fed. Malay Mus., **11**: 86, pl. 4 figs. 17, a, b.

Material examined. — Siam, Siamese Malaya, Nakron Sri Tamerat, 19.II.1922 (H. M. Pendleburry) 1 ♂ (type) BM. Siam, Ronpibun, 4.III.1922, 1 ♂, BM.

Description. — Colour. Head, thorax and abdomen brownish to castaneous-brown with black-brown tympanal coverings.

Head. Postclypeus twice as broad as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae.

Operculum. Shape of the operculum of the male as in *D. terpsichore* (cf. fig. 21). Basal half of the operculum rather broad, apical part narrowing to a sharply pointed apex. Operculum scarcely reaching the seventh abdominal segment.

Measurements. Male: length of the body 35.0 mm, length of the tegminum 45.0 mm.

A female of *D. kebuna* was not available for this study.

Habitat. — Siam.

Remarks. — Moulton (1923) recorded a female of this species from the same locality as the type specimen; only the male type specimen was deposited in the collection of the British Museum, so that we had no opportunity to examine the female.

D. kebuna is very closely allied to *D. terpsichore* and hardly separable on account of the castaneous-brown colour of the head, thorax and abdomen,

the black-brown tympanal coverings and the dark brown opercula. During a stay in the British Museum no time was available for studying the genitalia of the type specimen of *D. kebuna*, so that we cannot make a comparison of the structure of the male genitalia of *D. kebuna* with that of *D. terpsichore*. Consequently we have preferred to keep *D. kebuna* as a distinct species.

Dundubia emanatura Distant, 1889. Figs. 24, 47 & 48.

1889 *Dundubia emanatura* Distant, Ann. Mag. nat. Hist., (6) **3**: 51.

Material examined. — N. India, Kaswar (Atkinson) 1 ♂ (type) BM. India: Nilgiris, southern slopes, 12.VI.1888, 1 ♀, BM; Coorg, Mercara, III-IV.1924 (Maj. Fraser) 1 ♂, 1 ♀, BM; N. Kanara (R. T. Bell) 1 ♀, BM. Without locality: 5 ♂, 7 ♀, BM.

Description. — Colour. Head and thorax green to ochraceous. Head with a narrow black, transverse, fascia between the eyes enclosing the ocelli; pronotum with lateral marginal fasciae. Abdomen in both sexes ochraceous, in the female with lateral black fasciae on each side. Tegmina and wings hyaline.

Head. Postclypeus twice as broad at the base as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae.

Operculum. Operculum of the male (fig. 24) rather narrow, slightly curved laterad, constricted near the base. Apex of operculum rounded, reaching the sixth abdominal segment. Operculum of the female (fig. 48) with a rounded apex and a small lateral tooth.

Abdomen of the female (fig. 47). Tip of the abdomen in a lateral aspect sharply pointed and hardly curved upwards. Ovipositor rather long.

Measurements of the type. According to Distant (1889): length of the body 26 mm, expansion of the tegmina 72 mm.

Habitat. — India.

Remarks. — No material of this species was found in the collections of the Leiden and Amsterdam Museums. Unfortunately there was no time available for studying and drawing the male genitalia of *D. emanatura* in the British Museum. Nevertheless the species can be distinguished from the other known species of *Dundubia* by the transverse black fascia on the head and the male sex has a good structural character in the laterad curved operculum. The female of *D. emanatura* is very similar to *D. terpsichore* and *D. aerata* in the shape of the abdomen. Contrary to Distant's statement (1889) "The rostrum reaches the intermediate coxae", we have found a rostrum that just reaches the posterior coxae in all specimens of *D. emanatura* examined, including the type specimen.

Dundubia bifasciata Liu, 1940

1940 *Dundubia bifasciata* Liu, Bull. Mus. comp. Zool. Harv., **87**: 88, pl. 5 fig. 24.

We have not seen the type or other specimens of *D. bifasciata* Liu. From the description we can conclude that the species closely resembles *D. vaginata*

in size, colour and general appearance. However from this species *D. bifasciata* can be distinguished by the presence of two narrow black converging fasciae on the mesonotum and a transverse black spot before the middle of the pronotumcollar. The operculum of the male was described as follows: "Opercula greenish (in the paratype, the right one fuscous) with the outer margin near the base fuscous, reaching the posterior margin of the seventh ventrite, concavely sinuate near base and then ampliated and gradually narrowed toward the apex which is somewhat pointed".

Measurements. Length of the body 40 mm, length of tegminum 47 mm, greatest width of pronotum 13 mm.

Female unknown.

The male holotype and one male paratype came from Yungshien, Kwangsi.

Dundubia siamensis Haupt, 1918

1918 *Dundubia siamensis* Haupt, Stettin. ent. Ztg., **79**: 82—83, fig. 1.

We have not seen material of *D. siamensis*. The type of the species, probably in the collection of the Provinzial-Museum Hannover, could not be located.

From the description we can extract the following important characters: Head, thorax and abdomen black-brown. Abdomen with a black spot on the lateral side of the second to fourth abdominal segments. Opercula somewhat constricted at one third from the base, medial margin convex, lateral margin less convex. Tip of the operculum sharply pointed, reaching the penultimate abdominal segment.

Measurements. Length of the body 36 mm, expansion of the tegmina 98 mm.

Female unknown.

The male holotype (and only known specimen) came from North Siam.

Dundubia aerata Distant, 1888. Figs. 22—23, 49 & 50.

1888 *Dundubia aerata* Distant, Ann. Mag. nat. Hist., (6) **1**: 292.

Material examined. — Borneo, 1 ♂ (type) BM. Borneo: Elopura, III. 1884, 1 ♂, BM; Madang Ro, 21.III.1909, 1 ♀, BM; Madang Ro, 22.III.1909, 1 ♀, BM; Mahakkam, 1894 (Dr. Nieuwenhuis) 1 ♂, 1 ♀, RML. Sumatra, Pladjoe, 1923-1926 (Ir. P. van Hemert, leg. Dr. C. R. Bakker) 1 ♀. RML. Mentawei, 1894 (Modigliani) 1 ♂, BM. Without locality: 1 ♀, ZMA.

Description. — Colour. Head, thorax and abdomen olivaceous to dark ochraceous. Hind margins of the abdominal tergites more darkly coloured than the remaining part of the abdomen. Tegmina and wings bronzed hyaline, especially the apical areas of the tegmina bronze tinged.

Head. Postclypeus twice as broad at the base as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae. Apex of rostrum black.

Operculum. Operculum of the male (fig. 23) rather short. Lateral and

medial margins concavely sinuate towards the middle, apical part of the operculum rather narrow. Operculum reaching the fifth abdominal segment. Opercula of the female (fig. 50) broad near the base, apex obtusely pointed laterad.

Male genitalia (fig. 22). Uncus with two narrow, toothed lobes.

Abdomen of the female (fig. 49). In a lateral aspect sharply pointed and hardly curved upwards. Ovipositor very long.

Measurements. Male: length of the body 54.0 mm, length of tegminum 58.3 mm, greatest width of head 14.8 mm, based on one specimen. Female: length of the body 44.2—54.9 mm, length of tegminum 50.8—59.0 mm, greatest width of head 13.1—14.5 mm, based on 3 specimens.

Habitat. — Sumatra and Borneo. Also recorded from Java and the Malay Peninsula.

Remarks. — By its large size *D. aerata* is distinguished at first sight from the other species of *Dundubia*. The species most closely resembles *D. vaginata* but can easily be distinguished by having rather short male opercula, narrowing from the base to the apex, while the shape of the abdomen and the very long ovipositor renders it easy to distinguish the female.

Dundubia helena Distant, 1912. Fig. 25.

1912 *Dundubia helena* Distant, Ann. Mag. nat. Hist., (8) **9**: 641.

Material examined. — N. India, Dehra Dun, 1 ♂ (type) BM.

Description. — Colour. Head, thorax and abdomen ochraceous. Tegmina and wings hyaline.

Head. Postclypeus less than twice as broad at its base as the anterior lateral margins of the vertex. Rostrum reaching the posterior coxae.

Operculum (fig. 25). Operculum of the male narrow at its base, concavely sinuate on each side near the middle and extending to the seventh abdominal segment. Apical part of the operculum narrow, apex rounded.

Measurements of the type. According to Distant (1912): Length of the body 35 mm, expansion tegmina 80 mm.

Female unknown.

Habitat. — N. India.

Remarks. — The type from N. India in the collection of the British Museum is the only known specimen of this species. During our stay in London no time was available to study the genitalia. Nevertheless *D. helena* can easily be separated from the other species of the genus by the narrow operculum.

Dundubia longina Distant, 1917. Figs. 26 & 51.

1917 *Dundubia longina* Distant, Ann. Mag. nat. Hist., (8) **20**: 320.

Material examined. — Tonkin, 1917 (R. Vitalis de Salvaza) 1 ♂ (type), 1 ♀, BM.

Description. — Colour. Head, thorax and abdomen brownish ochraceous, somewhat pilose. A dark yellow spot at the apex of the postclypeus and the pronotum with a median, dark yellow, longitudinal fascia. Mesonotum with two rather narrow, converging, black lines. Tegmina and wings hyaline.

Head. Postclypeus less than twice as broad at the base as the anterior lateral margins of the vertex. Rostrum reaching the middle of the posterior coxae.

Operculum. — Operculum of the male (fig. 26) reaching the eighth abdominal segment. Operculum concavely sinuate on each side in the basal half. Apical part of the operculum rather broad, apex rounded.

Abdomen of the female (fig. 51). In a lateral aspect rather sharply pointed. Tip of the abdomen somewhat curved upwards.

Measurements of the type. According to Distant (1917): length of the body 42 mm, expansion tegmina 120 mm.

Habitat. — Tonkin.

Remarks. — Although the female bears the same label as the male type specimen of the species, Distant (1917) did not mention the female specimen in the description of *D. longina*.

D. longina resembles very much a species of the genus *Cosmopsaltria* Stål, 1866, namely *C. feae*, Distant, 1892. The male opercula of *D. longina* and *C. feae* are very similar. A study of the male genitalia is necessary to compare these two species.

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